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TITLE: **Image processing** apparatus and method

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Abstract Text - ABTX (1):

By smoothing a full**-color** image, staircasing of characters even in a gradation image is removed. An area to be smoothed is detected from image data having a plurality of **color** components, and image data included in the detected area is smoothed in units of **color** components. Image data which places an importance on resolution is smoothed by increasing the resolution to reproduce smooth characters and figures. Image data which places an importance on gradation characteristic is output without increasing the resolution, thus attaining high-gradation recording. A character or figure is detected from bitmap image data input from external equipment, and is smoothed. In correspondence with the density of the smoothed image data, the pulse width is switched, thereby changing the resolution of image data.

TITLE - TI (1):

Image processing apparatus and method

Brief Summary Text - BSTX (3):

The present invention relates to an **image processing** apparatus and method and, more particularly, to an **image processing** apparatus and method, which extract an image feature portion from **color** image data

electrically read based on an original image or **color** image data created by a computer, and process **color** image data to be output to, e.g., a printer on the basis of the extraction result.

Brief Summary Text - BSTX (4):

The present invention relates to an **image processing** apparatus and method and, more particularly, to an **image processing** apparatus and method, which smoothes a bit map image data showing character and figure output by external equipment.

Brief Summary Text - BSTX (6):

In recent years, a **color** printer apparatus which obtains **color** images by outputting digitally processed **color** image data, and a **color** image printing system such as a so-called digital **color** copying machine, and the like, which **color**-separates and electrically reads a **color** original image, and obtains a copy of a **color** image by printing out the read **color** image data onto a recording paper sheet have evolved remarkably. As such apparatuses prevail, requirements for image quality of **color** images are becoming stricter, and especially, requirements for printing black characters and lines more clearly and sharply are becoming stricter. More specifically, when a black original image is **color**-separated, yellow, magenta, cyan, and black signals are generated as those for reproducing black. When printing is done directly based on the obtained signals, since black is reproduced by superposing these four colors, a black thin line produces smear due to slight misregistration among the colors. As a result, black does not appear black or is blurred, thus

considerably deteriorating the print quality.

Brief Summary Text - BSTX (7):

On the other hand, in one method, information associated with black, **color** information associated with colors, and feature data of the spatial frequencies of thin lines, dot patterns, and the like are extracted from an image signal representing an image to be processed to detect, e.g., areas for black characters, **color** characters, and the like, and to also detect areas for a halftone image, dot pattern image, and the like, and **image processing** suitable for each detected area is done so as to express, e.g., black characters using black alone. Also, in another method proposed, a plurality of different thicknesses of characters and lines can be discriminated, and the **color** amount of black is adjusted or character and dot pattern edges are separately detected in accordance with the thicknesses of characters to execute different **image processing** operations for character edges in a dot pattern/halftone image or white background, thus attaining smooth black character processing. However, even after image area separation, since a printer having a resolution of about 400 dpi has a dot spacing of 63.5 microns, character and figure edges formed by dots look shaggy with the visual sense of a human being, that can distinguish up to about 20 microns, and the print quality is not so high.

Brief Summary Text - BSTX (8):

In order to improve the print quality, a system shown in FIG. 32 is known. In this conventional system, a page layout document for DTP, wordprocessing or graphic document, or the like is created using a host computer 1310, and is

printed out by a **color** printer (laser beam printer) via a raster image
processor 1313. Reference numeral 1311 denotes an application program running
on the host computer 1310, and for example, wordprocessing software such as
"Word" (trademark) available from Microsoft Corporation, page layout software
such as PageMarker (trademark) available from Adobe Corporation, and the like,
are popularly used. A digital document created by such software is sent to a
printer driver 1312 via an operating system (OS; not shown) of the computer.
This digital document is normally a set of command data that represent figures,
characters, and the like in one page, and these commands are sent to the
printer driver 1312. The commands are expressed as a language system called a
PDL (page description language), and GDI (trademark), PS (PostScript:
trademark), and the like are typical PDLs. The printer driver 1312 transfers
PDL commands output from the application 1311 to a rasterizer 1314 in the
raster image processor 1313. The rasterizer 1314 maps characters, figures, and
the like expressed by the PDL commands to an actual two-dimensional bitmap
image to be printed out. The rasterizer 1314 uses a frame as a two-dimensional
plane, and forms the bitmap image over the entire frame by one-dimensionally
repetitively scanning (rasterizing) in units of lines. The bitmap image mapped
by the rasterizer 1314 is temporarily stored in an image memory 1315.

Brief Summary Text - BSTX (9):

A document image displayed on the host computer 1310 is sent as PDL commands
to the rasterizer 1314 via the printer driver 1312, and the rasterizer 1314
maps a two-dimensional bitmap image onto the image memory 1315. The mapped

image data is sent to a **color** printer 1318. The **color** printer 1318 mounts a known electrophotographic image forming unit 1319, which prints out the image data by forming a visible image on a recording paper sheet. The image data in the image memory 1315 is transferred in synchronism with sync signals and clock signals required for operating the image forming unit 1319, or a specific **color** component signal, its request signal, and the like.

Brief Summary Text - BSTX (10):
Smoothing is known as a technique for improving the print quality by removing shagginess or staircasing of character and line image edges. However, no conventional method of satisfactorily smoothing multi-**color**, multi-valued image data is available.

Brief Summary Text - BSTX (11):
When full-**color** image data transferred from an external equipment includes both character and picture data, its image quality can be further improved using an adaptive processing circuit which is mounted on, e.g., a **color** copying machine or the like. However, character areas cannot always be detected 100% by image area separation, and may be erroneously detected in a natural image area, resulting in poor reliability.

Brief Summary Text - BSTX (12):
When characters and figures created by a personal computer are printed out as monochrome images using a 400-dpi printer, for example, if an image described in a page description language is rasterized, staircasing inevitably remains. In case of a **color** printout, since image data that places an importance on gradation may be simultaneously transferred,

if the resolution of such image data is also increased by smoothing in the same manner as in other areas, the image quality deteriorates.

Brief Summary Text - BSTX (14):

It is an object of the present invention to provide an **image processing** apparatus and method, which can eliminate staircasing in **color** characters and line images even in a gradation image by smoothing a multi-**color,** multi-valued image, and can improve the image quality.

Brief Summary Text - BSTX (15):

In order to achieve the above object, an **image processing** apparatus according to the present invention comprises the following arrangement.

Brief Summary Text - BSTX (16):

That is, an **image processing** apparatus comprises: input means for inputting multi-valued image data having a plurality of **color** components; detection means for detecting an area to be smoothed from the multi-valued image data having the plurality of **color** components; and smoothing means for smoothing multi-valued image data included in the area detected by the detection means in units of **color** components.

Brief Summary Text - BSTX (17):

In order to achieve the above object, an **image processing** method according to the present invention has the following features. That is, an **image processing** method comprises: the input step of inputting multi-valued image data having a plurality of **color** components; the detection step of detecting an

area to be smoothed from the multi-valued image data having the plurality of **color** components; and the smoothing step of smoothing multi-valued image data included in the area detected in the detection step in units of **color** components.

Brief Summary Text - BSTX (18):
It is another object of the present invention to provide an **image processing** apparatus and method, which can further improve image quality by executing adaptive processing of a full**-color** image input from an external equipment using image separation information and attribute map information.

Brief Summary Text - BSTX (19):
In order to solve the above-mentioned problems and to achieve the object, an **image processing** apparatus according to the present invention comprises the following arrangement.

Brief Summary Text - BSTX (20):
That is, an **image processing** apparatus comprises: input means for inputting a command that represents an image; bitmap data generation means for generating bitmap data on the basis of the command that represents the image; and attribute generation means for generating attribute information on the basis of an attribute of an object that forms an image, and the bitmap data.

Brief Summary Text - BSTX (21):
An **image processing** method according to the present invention has the following features.

Brief Summary Text - BSTX (22):
That is, an **image processing** method comprises: the input step of inputting a command that represents an image; the bitmap data generation step of generating bitmap data on the basis of the command that represents the image; and the attribute generation step of generating attribute information on the basis of an attribute of an object that forms an image, and the bitmap data.

Brief Summary Text - BSTX (23):
It is still another object of the present invention to provide an **image processing** apparatus and method, which can reproduce smooth characters and figures by increasing their resolution by smoothing their edges, and can output image data, which places an importance on gradation, without increasing its resolution, even when such image data is transferred.

Brief Summary Text - BSTX (24):
In order to solve the above-mentioned problems and to achieve the above object, an **image processing** apparatus according to the present invention comprises the following arrangement.

Brief Summary Text - BSTX (25):
That is, an **image processing** apparatus comprises: input means for inputting image data having a plurality of **color** components, obtained by **color**-separating an image; detection means for detecting an area to be smoothed from the image data having the plurality of **color** components; smoothing means for smoothing the image data having the plurality of **color** components included in the area detected by the detection means; output means for outputting a recording signal of a predetermined resolution on the basis of the smoothed

image data; and
switching means for switching an output resolution of the output means.

Brief Summary Text - BSTX (26):
An **image processing** method according to the present invention has the following features.

Brief Summary Text - BSTX (27):
That is, an **image processing** method comprises: the input step of inputting image data having a plurality of **color** components, obtained by **color**-separating an image; the detection step of detecting an area to be smoothed from the image data having the plurality of **color** components; the smoothing step of smoothing the image data having the plurality of **color** components included in the area detected in the detection step; the output step of outputting a recording signal of a predetermined resolution on the basis of the smoothed image data; and the switching step of switching an output resolution of the output step in correspondence with a characteristic of the smoothed image data.

Drawing Description Text - DRTX (3):
FIG. 2A is a perspective view showing a **CCD** 210 used in the apparatus shown in FIG. 1;

Drawing Description Text - DRTX (30):
FIG. 27 is a block diagram showing an **image processing** system according to the second embodiment of the present invention;

Drawing Description Text - DRTX (35):
FIG. 32 is a block diagram showing a conventional **image processing** system;

Drawing Description Text - DRTX (37):
FIG. 34 is a block diagram showing the detailed arrangement of the **image processing** unit 209 shown in FIG. 1;

Drawing Description Text - DRTX (39):
FIGS. 36 to 38 show examples of memory maps when the **image processing** method of the present invention is stored in a storage medium.

Detailed Description Text - DETX (5):
In FIG. 1, an image scanner module 201 reads an original image, and performs digital signal processing of the read image. A printer module 200 prints out a full-**color** image corresponding to the original image read by the image scanner module 201 onto a paper sheet.

Detailed Description Text - DETX (6):
In the image scanner module 201, light emitted by a halogen lamp 205 and to be irradiated onto an original 204 on an original table glass (to be referred to as a platen hereinafter) 203 is irradiated onto an original pressing plate 202. Light reflected by the original is guided by mirrors 206 and 207, and is imaged on a 3-line sensor (to be referred to as a **CCD** hereinafter) 210 via a lens 208. The lens 208 has an infrared cut filter 231.

Detailed Description Text - DETX (7):
The **CCD** 210 **color**-separates optical information obtained from the original, reads the red (R), green (G), and blue (B) components of full-**color** information, and sends them to a signal processing unit 209.

Detailed Description Text - DETX (8):
Each of **color** component read sensor arrays of the **CCD** 210 is comprised of 5,000 pixels. With these pixels, the **CCD** 210 reads the widthwise direction (297 mm) of an A3-size original as a maximum one of those placed on the platen 203 at a resolution of 400 dpi.

Detailed Description Text - DETX (9):
Note that a first sub-scanning unit (205 and 206) scans the entire original surface when it mechanically moves in a direction (to be referred to as a sub-scanning direction hereinafter) perpendicular to an electrical scanning direction (to be referred to as a main scanning direction hereinafter) of the **CCD** at a velocity v, and a second scanning unit (207) scans the entire original surface when it mechanically moves in the direction perpendicular to the electrical scanning direction of the **CCD** at a velocity 0.5 v.

Detailed Description Text - DETX (13):
An image signal, i.e., one of M, C, Y, and BK **color** components sent from the image scanner module 201 is supplied to a laser driver 212. The laser driver 212 modulates and drives a semiconductor laser 213 in correspondence with the image signal. A laser beam scans the surface of a photosensitive drum 217 via a polygonal mirror 214, f-.theta. lens 215, and mirror 216.

Detailed Description Text - DETX (14):
Reference numerals 219 to 222 denote magenta, cyan, yellow, and black developers. These four developers alternately contact the photosensitive drum to develop an electrostatic latent image of one of the M, C, Y, and BK **color**

components formed on the photosensitive drum 217 with corresponding toner.

Detailed Description Text - DETX (16):
With the above-mentioned procedure, a total of four **color** images are
frame-sequentially transferred onto the paper sheet in units of M, C, Y, and BK
color components, and the paper sheet is then exhausted via a fixing unit 226.

Detailed Description Text - DETX (19):
FIG. 2A shows the outer appearance of the **CCD** 210 used in the apparatus
shown in FIG. 1.

Detailed Description Text - DETX (22):
These three light-receiving element arrays having different optical
characteristics are monolithically formed on a single silicon chip so that the
R, G, and B **sensor** arrays are disposed **parallel** to each other to read an
identical line on an original.

Detailed Description Text - DETX (23):
Using the **CCD** with this arrangement, a common optical system such as a lens
and the like can be used upon reading separated colors.

Detailed Description Text - DETX (24):
In this way, optical adjustment in units of R, G, and B **color** components can
be simplified.

Detailed Description Text - DETX (34):
A luminance-density converter 103 converts three primary **color** signals R, G,
and B transferred from the **CCD** 210 or the external equipment into density
signals Y, M, C, and K, and frame-sequentially outputs the

density signals to
have a predetermined bit width (8 bits).

Detailed Description Text - DETX (40):
FIG. 5 shows the detailed arrangement of the luminance calculation circuit 301. In FIG. 5, multipliers 401, 402, and 403 respectively multiply input **color** component signals R, G, and B by coefficients "0.25", "0.5", and "0.25", and adders 404 and 405 add the products to obtain the luminance signal Y given by equation (1).

Detailed Description Text - DETX (48):
As shown in FIG. 8, maximum and minimum value detectors 701 and 702 respectively extract maximum and minimum values MAX(r, g, b) and MIN(r, g, b) from **color** component signals R, G, and B, and a subtracter 703 calculates a difference .DELTA.C between these maximum and minimum values. An LUT (look-up table) 704 converts the difference .DELTA.C in accordance with the characteristics shown in FIG. 9, thus generating a saturation signal Cr. In FIG. 9, as .DELTA.C is closer to "0", saturation is lower (closer to achromatic **color**); as .DELTA.C is larger, the **color** is closer to chromatic **color**. Hence, from the characteristics shown in FIG. 9, Cr assumes a larger value as the **color** is closer to achromatic **color,** and approaches "0" as the **color** is closer to chromatic **color**. The signal Cr changes at the rate shown in FIG. 9. Note that the output signal col shown in FIG. 3 expresses **color,** black, intermediate (**color** between the **color** and black), and white using 2-bit codes.

Detailed Description Text - DETX (51):
In FIG. 10, **color** component signals R, G, and B are

input to a minimum value
detection circuit 901. The minimum value detection circuit 901 detects a
minimum value MINR, MING, or MINB of the input R, G, and B signals. The value
MINR, MING, or MINB is input to an **average** value detector 902 to calculate an
average value AVE5 of MINR, MING, or MINB in 5 pixels.times.5 pixels around the
pixel of interest, and an **average** value AVE3 of MINR, MING, or MINB in 3
pixels.times.3 pixels around the pixel of interest.

Detailed Description Text - DETX (52):
The values AVE5 and AVE3 are input to a character/halftone detector 903.
The character/halftone detector 903 detects the change amount between the
density of the pixel of interest and the **average** density of the pixel of
interest and its surrounding pixels in units of pixels, thus discriminating if
the pixel of interest is a portion of a character or halftone area.

Detailed Description Text - DETX (74):
FIG. 21 shows the detailed arrangement of the smoothing circuit 104 shown in
FIG. 3. In FIG. 21, C, M, Y, and K **color** component signals are
frame-sequentially transferred as an image signal, and the following processing
is done in units of **color** components. A binarization circuit 1001 binarizes
the input signal for the next pattern matching. A pattern matching circuit
1002 performs pattern matching based on the binary signal. A smoothing
processing circuit 1003 smoothes staircasing patterns using data with a
resolution twice the original resolution. Note that the data to be substituted
by interpolation is determined by checking the density data of surrounding
pixels.

Detailed Description Text - DETX (77):
The smoothing circuit 1003 will be explained below. FIG. 25 is a view for explaining an example of smoothing rasterized density data 255 in a line having one pixel width. As shown in FIG. 25, the interpolation amount of image data is replaced by multi-valued data in correspondence with the input pattern. Furthermore, since the input image signal is data having multi-valued gradation characteristics, it is not always data 0 or 255. Hence, as shown in FIG. 26, the multi-valued pattern of the input image signal is checked using a 3.times.3 window. That is, the number of data other than 0 is counted within the 3.times.3 window, and the **average** value of the data other than 0 is calculated to obtain data to be smoothed by a linear calculation, thus attaining data interpolation. A data interpolation example will be explained below.

Detailed Description Text - DETX (81):
To restate, according to the first embodiment, even when a raster image from the external equipment or the image read by the image scanner module 201 is input in units of Y, M, C, and K **color** components, density interpolation is executed in correspondence with every image patterns of characters, lines, and the like, thus allowing smoother smoothing and improving the quality of characters and figures.

Detailed Description Text - DETX (82):
Since a multi-**color,** multi-valued image is smoothed in units of **color** components, staircasing of **color** characters and line images even in a gradation image can be eliminated, thus improving the image quality.

Detailed Description Text - DETX (84):
An **image processing** system of the second embodiment will be explained below.

Detailed Description Text - DETX (85):
FIG. 27 is a block diagram showing an **image processing** system of the second embodiment.

Detailed Description Text - DETX (87):
In FIG. 27, the characteristic feature of the second embodiment lies in that an attribute map memory 1316 is added to a raster image processor 1313, and an image processor 1317 is added to a **color** printer 1318.

Detailed Description Text - DETX (88):
A rasterizer 1314 generates attribute map information by a method to be described later on the basis of object attributes and the generated bitmap image upon generating the bitmap image on an image memory 1315 on the basis of commands corresponding to individual objects that form an image. More specifically, the rasterizer 1314 generates attribute map information on the basis of attributes of commands that represent the objects, and the bitmap image generated to be written in the image memory 1315. Note that the contents on the image memory 1315, that have already been mapped to a bitmap image can be referred to. The image processor 1317 of the **color** printer 1318 performs various kinds of **image processing** for the bitmap image on the image memory 1315, and outputs bitmap data to an image forming unit 1319. Also, the image processor 1317 appropriately switches the **image processing** method with reference to attribute information on the attribute map

memory 1316.

Detailed Description Text - DETX (91):
FIG. 29A shows bitmap data to be written in the image memory 1315; pixel values in units of micro-pixels are two-dimensionally arranged as, e.g., 8-bit **integer** values.

Detailed Description Text - DETX (96):
The edge boundary flag is generated at both the inside and outside an edge, as shown in FIG. 29E, by detecting four **neighboring pixels** of a pixel, the edge flag of which is "1", and setting "1" at those pixel positions.

Detailed Description Text - DETX (97):
On the other hand, in some cases, only pixels outside an edge are preferably set at "1" depending on the **image processing** contents. In such case, edge boundary flags are inhibited from being generated on the halftone portion (an area indicated black) inside the circle by referring to the original image memory simultaneously with the edge flags shown in FIG. 29D.

Detailed Description Text - DETX (105):
A luminance-density converter 103 converts three primary **color** signals R, G, and B transferred from the density-luminance converter 102 into density signals Y, M, C, and K, and frame-sequentially outputs the density signals to have a predetermined bit width (8 bits).

Detailed Description Text - DETX (121):
In FIG. 33, a signal S1 is a printer pixel clock signal corresponding to a resolution of 400 dpi. The printer pixel clock signal S1

is generated by the
laser driver 212. A 400-line triangular wave S2 is generated in synchronism
with the printer pixel clock signal S1. The period of the 400-line triangular
wave S2 is the same as that of the printer pixel clock signal S1.
256-gradation (8-bit) M, C, Y, and BK image data transferred from the **image**
processing unit 209 shown in FIG. 1, and a line number switching signal S8 for
switching 400 lines/800 lines are synchronized with the printer pixel lock
signal S1 by a FIFO memory (not shown) in the laser driver 212, and are
transferred in synchronism with the printer pixel clock signal S1.

Detailed Description Text - DETX (142):
As shown in FIG. 25, the interpolation amount of image data is replaced by
multi-valued data in correspondence with the input pattern. Furthermore, since
the input image signal is data having multi-valued gradation characteristics,
it is not always data 0 or 255. Hence, as shown in FIG. 26, the multi-valued
pattern of the input image signal is checked using a 3.times.3 window. That
is, the number of data other than 0 is counted within the 3.times.3 window, and
the **average** value of the data other than 0 is calculated to obtain data to be
smoothed by a linear calculation, thus attaining data interpolation. A data
interpolation example will be explained below.

Detailed Description Text - DETX (144):
To restate, according to the third embodiment, even when a raster image is
input from the external equipment in units of Y, M, C, and K **color** components,
density interpolation is executed in correspondence with every image patterns
of characters, lines, and the like, thus allowing smoother

smoothing and
improving the quality of characters and figures.

Claims Text - CLTX (1):
1. An **image processing** apparatus characterized by comprising: input means for inputting multi-valued image data having a plurality of **color** components; detection means for detecting a character image portion and a line image portion based on the multi-valued image data having the plurality of **color** components; and smoothing means for interpolating the density of the multi-valued image data in units of **color** components to enhance a resolution of the multi-valued image data, the multi-valued image data included in an area detected by said detection means.

Claims Text - CLTX (2):
2. The apparatus according to claim 1, characterized in that said smoothing means further comprises resolution conversion means for generating image data having a resolution twice a resolution of the multi-valued image data having the plurality of **color** components from the multi-valued image data in the area detected by said detection means.

Claims Text - CLTX (3):
3. The apparatus according to claim 2, characterized in that said resolution conversion means generates image data having a resolution corresponding to a natural number multiple of the resolution of the multi-valued image data having the plurality of **color** components from the multi-valued image data in the area detected by said detection means.

Claims Text - CLTX (4):
4. The apparatus according to claim 3, characterized in that said
resolution conversion means generates image data having a resolution
corresponding to the natural number multiple of the resolution of the
multi-valued image data having the plurality of **color** components by
interpolating the resolution of the multi-valued image data.

Claims Text - CLTX (5):
5. The apparatus according to claim 2, characterized in that said
resolution conversion means generates image data having a resolution twice the
resolution of the multi-valued image data having the plurality of **color**
components by interpolating the resolution of the multi-valued image data.

Claims Text - CLTX (6):
6. The apparatus according to claim 1, characterized in that the
multi-valued image data having the plurality of **color** components is full-**color**
image data which is **color**-separated into yellow, magenta, cyan, and black
components.

Claims Text - CLTX (7):
7. The apparatus according to claim 1, characterized in that the
multi-valued image data having the plurality of **color** components is input from
external equipment.

Claims Text - CLTX (9):
9. An **image processing** method characterized by comprising: the input step
of inputting multi-valued image data having a plurality of **color** components;

the detection step of detecting a character image portion and a line image
portion based on the multi-valued image data having the plurality of **color**
components; and the smoothing step of interpolating the density of the
multi-valued image data in units of **color** components to enhance a resolution of
the multi-valued image data, the multi-valued image data included in an area
detected in the detection step.

Claims Text - CLTX (10):
10. The method according to claim 9, characterized in that the smoothing
step further comprises the resolution conversion step of generating image data
having a resolution twice a resolution of the multi-valued image data having
the plurality of **color** components from the multi-valued image data in the area
detected in the detection step.

Claims Text - CLTX (11):
11. The method according to claim 10, characterized in that the resolution
conversion step includes the step of generating image data having a resolution
corresponding to a natural number multiple of the resolution of the
multi-valued image data having the plurality of **color** components from the
multi-valued image data in the area detected in the detection step.

Claims Text - CLTX (12):
12. The method according to claim 11, characterized in that the resolution
conversion step includes the step of generating image data having a resolution
corresponding to the natural number multiple of the resolution of the
multi-valued image data having the plurality of **color** components by

interpolating the resolution of the multi-valued image
data.

Claims Text - CLTX (13):
13. The method according to claim 10, characterized in that the resolution
conversion step includes the step of generating image data having a resolution
twice the resolution of the multi-valued image data having the plurality of
color components by interpolating the resolution of the multi-valued image
data.

Claims Text - CLTX (14):
14. The method according to claim 9, characterized in that the multi-valued
image data having the plurality of **color** components is full-**color** image data
which is **color**-separated into yellow, magenta, cyan, and black components.

Claims Text - CLTX (15):
15. The method according to claim 9, characterized in that the multi-valued
image data having the plurality of **color** components is input from external
equipment.

Claims Text - CLTX (17):
17. A computer-readable memory which stores a program code of **image**
processing, characterized by comprising: a code of the input step of inputting
multi-valued image data having a plurality of **color** components; a code of the
detection step of detecting a character image portion and a line image portion
based on the multi-valued image data having the plurality of **color** components;
and a code of the smoothing step of interpolating the density of the
multi-valued image data in units of **color** components to

enhance a resolution of
the multi-valued image data, the multi-valued image data
included in an area
detected in the detection step.